METHOD OF FORMING DUMMY WAFER

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present invention relates to a method of fabricating a dummy wafer, in particular to a dummy wafer that is used in the plasma cleaning and so on.

2. DESCRIPTION OF THE RELATED ART

In existing plasma-generating semiconductor fabrication apparatus, when a wafer is processed, reaction products adhere to a processing chamber and floating dust resulting therefrom is generated. In the case of the reaction product adhering to the wafer, a semiconductor element formed on the wafer deteriorates in the characteristics and owing to the floating dust the pattern short defect or the like increases; accordingly, periodical in-line cleaning of the inside of the chamber has to been carried out.

At this time, in order to inhibit a lower electrode base material in the chamber from deteriorating owing to the plasma and to suppress the inside of the chamber from being contaminated, a silicon (Si) dummy wafer is used to be placed in the chamber and to be subjected to the plasma processing. As the dummy wafer for use in the cleaning, since a gas for decomposing the reaction product with the plasma thereof is supplied in the chamber, not a bare silicon wafer but a wafer

provided with a silicon oxide film (SiO_2) is used.

However, the wafer with silicon oxide film, when exposed to the plasma, is etched and the silicon oxide film is removed from on the silicon wafer. Accordingly, the silicon oxide film is repeatedly formed. In the regeneration of the silicon oxide film, after the wet etching, a silicon oxide film is formed; accordingly, it takes operation steps and fabrication time due to the regeneration.

Furthermore, the number of times of regeneration of the dummy wafer, owing to deterioration of a surface state of the wafer itself and the warping thereof, is increased so that a use lifetime of the silicon wafer is shorten; that is, in total, the number of the wafers that are used results in an increase and the fabrication cost results in an increase. Still furthermore, as other dummy wafer, a ceramic wafer can be considered; however, it is high in the cost. In addition, being different in the surface roughness from that of the silicon wafer when transferring the wafer in the semiconductor fabrication apparatus, or being different in the light reflectance from that of silicon material at the sensing, it is not suitably used in the semiconductor fabrication apparatus in which the silicon wafer is transferred.

SUMMARY OF THE INVENTION

A method of forming a dummy wafer according to a first

invention includes forming a masking film on a rear surface of a silicon wafer; spray coating aluminum and thereby depositing an aluminum film on a front surface of the silicon wafer; spray coating ceramics or carbon and thereby depositing a ceramic film or carbon film on the aluminum film so that the aluminum film may be completely covered; and removing the masking film formed on the rear surface.

A method of forming a dummy wafer according to a second invention includes polishing a rear surface of an aluminum wafer; and after the polishing, a front surface of the aluminum wafer is subjected to anodic oxidation and thereby forming a film of aluminum oxide. The rear surface of the aluminum wafer is polished to mirror-finish.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs.1A through 1C are sectional views showing a method of fabricating a dummy wafer in which a ceramic film is formed on a silicon wafer;

Fig.2 is an enlarged view of an end portion of the wafer shown in Fig.1C;

Fig.3 is a sectional view showing a dummy wafer that has a film thickness distribution according to a first embodiment;

Fig.4 is a sectional view showing a dummy wafer according to a first embodiment in which a portion with which a clamp comes into contact is made thin in the film thickness; and

Fig.5 is a sectional view showing an aluminum wafer in a state being subjected to the anodic oxidation according to a second embodiment.

DETAILED DESCRIPTION OF THE INVENTION

(First Embodiment)

First, a rear surface of a silicon wafer 1 is masked with a mask 2 such as a film and so on (Fig.1A). Subsequently, on a front surface of the silicon wafer 1, without applying the blasting, an aluminum (Al) film 3 is spray coated to form a film (Fig.1B). On the spray coated aluminum film 3, ceramics that are an aluminum compound is spray coated, and thereby on an entire surface a ceramic film 4 is formed (Fig.1C).

In the above, when the aluminum film 3 is formed as an undercoating, because of difference of the surface roughness between silicon and aluminum and a higher bonding strength between the ceramics (aluminum oxide) that is an aluminum compound and the aluminum than that of silicon and aluminum, without applying the blasting, the ceramics can be spray coated. At this time, the aluminum film 3 at an edge of the silicon wafer 1 is covered with a ceramic spray coating film 4 (Fig.2).

Thereafter, the mask 2 on the rear surface of the silicon wafer 1 is removed, followed by washing with deionized water. The ceramic film 4, being excellent in the plasma resistance, even when exposed to the plasma, is slight in a polished amount,

causing no problem in the environmental pollution. According to the present fabricating method, a film thickness of the aluminum spray coated film 3 as the undercoating is not particularly restricted. As to the film during the alumina spray coating, there are methods of forming flat and forming with a thickness distribution in a plane.

Furthermore, when the aluminum film is spray coated on the silicon wafer surface, a bonding strength between silicon and aluminum is increased, furthermore when the ceramics are spray coated on the aluminum surface, the bonding strength between the aluminum film and the ceramic film is increased; accordingly, the ceramic film can be formed thicker. At the edge portion of the silicon wafer, by covering the spray coated aluminum film, the aluminum can be suppressed from being contaminated.

Furthermore, when the thickness distribution in a plane is changed, a wafer structure fit to the characteristics of the apparatus that is used can be formed. That is, by generating thicker a portion in a plane that is fast in the etching rate, a replacement interval can be extended (Fig.3).

In the present embodiment, an example suitable for the apparatus that has no relation to the clamp is explained; however, when the invention is applied to the apparatus having a clamp, a clamp portion is formed into a film thickness of 670 μm, and a portion other than the clamp portion is made

thicker in the spray coating film thickness, and thereby the replacement period of the wafer can be made further longer (Fig.4).

When the carbon spray coating thin film is used instead of the ceramic spray coating film, it can be used as a wafer for confirming wafer transfer. In this case, aluminum is used as the undercoating, and black carbon is spray coated thereon; accordingly, when the wafer that is spray coated with carbon is bruised during the transfer, the bruised portion can be seen white, resulting in enabling to judge transfer displacement. At this time, when the carbon thickness is differentiated between the wafers, with wafers different in the depth of the bruise and in the carbon spray coating film thickness, a height of the transfer displacement can be judged (Fig.5).

(Second embodiment)

First, an aluminum substrate 11 is cut to a thickness of 1000 μm and formed into a shape the same as that of a wafer. All are the same with respect to presence or absence of an orientation flat and a notch. A surface of the wafer is polished, an electrode 12 is attached to a rear surface of the wafer, and a portion other than the electrode 12 is covered with a masking material 13 (Fig.5). The masking material may be any one as far as it can withstand an acid that is used when the anodic oxidation is applied. According to the anodic

oxidation, an aluminum oxide film 14 having a thickness of 100 μm or more is formed on a front surface of the wafer. In the next place, the rear surface of the wafer is polished, and thereby a rear surface of the aluminum substrate 11 is polished to mirror finish. At this time, a thickness of aluminum is adjusted to substantially 670 μm, followed by washing the aluminum wafer with deionized water.

As mentioned above, in the mode of the present embodiment, an aluminum substrate is used, and thereby the wafer can be made lighter in weight. Aluminum oxide is superior in the plasma resistance to an existing silicon oxide film and smaller in an amount polished during etching. Accordingly, even in the plasma cleaning, a replacement lifetime can be made longer. In the mode according to the present embodiment, though the hardness varies depending on the film thickness of aluminum oxide, in order to have sufficient plasma resistance, a thickness of 100 μm or more is preferable.

Furthermore, by controlling the conditions for forming aluminum oxide and thereby forming a thin film having a thickness of 30 μm or less, or by lowering the hardness of the film, the aluminum wafer can be utilized as a dummy wafer for confirming wafer transfer. Since the substrate of the aluminum oxide film that is normally looked brown black is aluminum, a bruised portion of the wafer is seen whitish owing to the irregularity during the wafer transfer confirmation,

and thereby misalignment during the wafer transfer can be detected.